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(21) International Application Number: PCT/GB99/00554 (22) International Filing Date: 23 February 1999 (23.02.99) (30) Priority Data: 09/028,075 23 February 1998 (23.02.98) US (71) Applicant: GILBARCO LTD. [GB/GB]; Crompton Close, Essex SS14 3BA (GB). (72) Inventors: LONG, Joseph, D.; 4906 Hickory Woods Drive, Greensboro, Guilford, NC 27410 (US). MILLER, Paul, D.; 4675 Gallant Lane, Winston-Salem, Forsyth, NC 27101 (US). BLALOCK, Dolan, F.; 2404 Morning Glory Drive, Kernersville, Forsyth, NC 27284 (US). (74) Agent: FITCHETT, Stuart, Paul; GEC Patent Dept., Water- house Lane, Chelmsford, Essex CM1 2QX (GB).		(81) Designated States: AU, BR, NZ, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>
(54) Title: FUEL DISPENSER (57) Abstract <p>The present invention provides a fuel dispenser capable of sensing the proximity and/or location of a customer relative to the fuel dispenser without requiring direct customer contact and controlling the display or aspects of the display accordingly to conserve energy, reduce heat generation or draw the customer's attention to the display once the customer is within a relative proximity to the fuel dispenser.</p>		

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FUEL DISPENSER

The present invention relates to fuel dispensers.

In recent years, traditional fuel dispensers have evolved into elaborate point-of-sale (POS) devices having sophisticated control electronics and user interfaces with large displays and touch-pads or screens. The dispensers include various types of payment means, such as card readers, to expedite and further enhance fuelling and retail ordering transactions. Nowadays, a customer is not limited to the purchase of fuel at the dispenser. More recent dispensers allow the customer to purchase services, such as car washes, and goods such as fast food or convenience store products at the dispenser. Once purchased, the customer need only to pick up the goods and services at the station store or at the outlet of a vending machine.

In order to make customer interfaces more efficient and easy to use, the fuel dispenser displays have grown larger and the menu and instruction interfaces have become more complicated. The resulting increase in size and complexity has led to significant increases in power consumption and heat buildup, primarily due to the large displays, and, in particular, the back-lighting associated with these displays. The increase in heat buildup has resulted in the need to add auxiliary cooling systems to cool the multiple displays in each fuel dispenser.

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In addition to the increased power consumption and heat generation, station operators have found that many customers fail to recognize the need to interact with the customer

interface to initiate dispenser operation and card authorisation, even though various stickers and decals have been used to provide initial instructions, such as "press here to begin." Many customers fail to recognise or even read the information on the display and search for other "hard" buttons to initiate fuelling.

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The present invention provides a fuel dispenser comprising: a housing and delivery hardware for delivery of fuel to a vehicle; display means within said housing having a first and second mode; proximity sensing electronics associated with said housing and adapted to sense proximity of a customer relative to said housing; and a control system coupled with said display means and said proximity sensing electronics and adapted to operate said display means in the first mode and operate said display means in the second mode when a customer is in a predetermined position relative to said dispenser.

Advantageously, the dispenser is arranged so that the position is within a predetermined proximity relative to said dispenser.

The fuel dispenser is capable of sensing the proximity or location of a customer relative to the fuel dispenser without requiring direct customer contact and controlling the display or aspects of the display accordingly to conserve energy, reduce heat generation or draw the customer's attention to the display once the customer is within a relative proximity to the fuel dispenser.

The control system may provide a dimmer display in the first mode and a brighter display for the second mode. The first and second modes may correspond to inactive and active

display states, respectively. If the display is a liquid crystal display, or like display, having back-lighting, the control system may be adapted to operate the back-lighting in a reduced level in the first mode and at an increased level in the second mode. The back-lighting may be turned completely off or reduced in some fashion to conserve energy. Reducing or
5 eliminating back-lighting during non-fuelling periods helps avoid the need to add active cooling systems to the dispensers. These systems require additional energy for operation and add significant expense to the cost of manufacturing dispensers.

Alternatively, the control system may provide a first display having graphics and/or video
10 information pertaining to periods between transactions in the first mode, and a second display pertaining to periods of transaction, especially the beginning of a transaction, in the second mode. The information displayed may be graphics information from a graphic generator associated with the control system or new video information from a video source associated with or controlled by the control system.

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Another aspect of the present invention integrates the proximity sensing electronics and the display electronics wherein the display is configured to operate in a highly sensitive mode to sense customers proximate to the display in the first mode and in a less sensitive mode to provide a touch screen display in the second mode. Alternatively, the proximity
20 sensing electronics may include one or more proximity sensors located at various points on the fuel dispenser to sense the proximity of a customer relative to the fuel dispenser. The sensors may be used to simply sense the approach and/or presence of a customer relative to the fuel dispenser or may be configured to provide signals to the control system indicative of varying degrees of relative proximity. In the latter case, the control system

may be adapted to determine the approximate relative location of a customer with respect to the fuel dispenser and adjust aspects of the display accordingly. For example, the location information determined by the control system may be used to adjust the viewing angle to optimize customer viewing or may be used to change the font or point size of text
5 appearing on the display.

Another aspect of the present invention provides a method of operating a fuel dispenser. The method includes the steps of operating a fuel dispenser display means in a first mode; sensing a customer within a predetermined proximity relative to the fuel dispenser; and
10 operating the fuel dispenser display means in a second mode upon sensing the customer within the predetermined proximity.

In those embodiments having dedicated proximity sensors, any type of proximity sensing devices are acceptable. These devices include infrared sensors and radio frequency (RF)
15 sensors, such as radar systems. When the touch screen display is used to sense proximity, a touch screen display capable of operating at various frequencies and sensitivities is preferred.

These and other aspects of the present invention will become apparent to those skilled in
20 the art after reading the following description of the preferred embodiments when considered with the drawings, in which:-

Figure 1 is a schematic representation of a fuel dispenser constructed according to the present invention;

Figure 2 is a schematic representation of a display and associated dispenser electronics constructed according to the present invention;

Figure 3 is a schematic representation of a display associated with plural proximity sensors
5 constructed according to the present invention;

Figure 4 is a flow chart of a basic process of controlling a display based on proximity of a customer according to the present invention; and

10 Figures 5A and 5B are a flow chart of a basic process of controlling a fuel dispenser display based on proximity and location of a customer according to the present invention.

In the following description, like reference characters designate like or corresponding parts throughout the several figures. It should be understood that the illustrations are for the
15 purpose of describing preferred embodiments of the invention and are not intended to limit the invention thereto.

As best seen in Figure 1, a fuel dispenser, generally designated 10, is shown constructed according to the present invention. The fuel dispenser provides a fuel delivery path from
20 an underground storage tank to a vehicle (not shown). The delivery path includes a fuel delivery line 12 having a fuel metering device 14. A fuel delivery line 12 communicates with a fuel delivery hose 16 outside of the dispenser 10 and a delivery nozzle 18. The nozzle 18 provides manual control of fuel delivery to the vehicle.

The dispenser 10 generally includes a control system (hereinafter referred to as controller 20) and associated memory 22. The controller 20 may receive volume data from the metering device 14 through cabling 24 as well as provide control of fuel delivery. The controller 20 may provide audible signals to an audio module and speaker 26 in order to
5 provide various beeps, tones and audible messages to an operator. These messages may include warnings, instructions and advertising.

The dispenser 10 may be equipped with a card reader 28 or a cash acceptor 30 and a receipt printer 32. With these options, the dispenser controller 20 may read data from a
10 magnetic strip when a card is inserted in the card reader 28 and communicate to a service-station-based controller, such as the G-site controller sold by Gilbarco, Inc. of Greensboro, North Carolina. The service station based controller generally communicates with a remote credit card verification authority to ascertain whether a transaction proposed to be charged to or debited from the account associated with the card inserted in the card
15 reader 28, is authorised.

The dispenser 10 may also include various types of displays, preferably, one or more alpha numeric displays 36 in addition to a high resolution graphics display 40. Preferably, the graphics display 40 will have an associated graphics display keypad 42 adjacent the
20 display or integrated with the graphics display 40 to provide a touch screen interface. The display will preferably receive video and graphics images from one or more video sources 52 and graphics generator 50 through video mixer and driver electronics 46 (as shown in Figure 2). The dispenser may have an additional general keypad 44. Notably, the displays 36, 40 and keypads 42, 44 may be integrated into a single device. The controller 20 is

desirably comparable to the microprocessor based control systems used in CRIND (card reader in the dispenser) and TRIND (tag or transponder reader in the dispenser) type units sold by Gilbarco, Inc. under the trademark THE ADVANTAGE.

- 5 The fuel dispenser will include proximity sensing means adapted to provide a signal to the control system indicating a customer is within (1) a predetermined proximity of the dispenser, (2) a relative proximity with respect to the dispenser, or (3) a relative location with respect to the dispenser. The proximity sensing means may be provided by one or more proximity sensors 48 or a highly sensitive touch screen display configuration, such
10 as display 40.

In the first embodiment, the proximity sensors 48 may be mounted anywhere on or near the fuel dispenser 10 and configured to provide a signal to the controller 20 indicative of the proximity of a customer with respect to the fuel dispenser. In the second embodiment,
15 the touch screen 40 will operate in a highly sensitive mode wherein the display is sensitive to a customer's presence near the display. A customer need not touch the display to alert the control system to his or her presence in this highly sensitive mode.

Once a customer is detected using the proximity sensing means, the controller 20 may
20 operate in several ways including alerting the customer that interaction with the touch screen display is necessary for conducting the fuelling operation, exiting out of a power saving mode, altering the graphics or video provided at the display 40, and/or changing the display's viewing angle to optimize customer viewing based on customer location. Although these actions are preferred, the scope of the invention should not be limited

thereto. Those of ordinary skill in the art will quickly recognize various dispenser control functions that could be facilitated upon sensing the approach and/or location of a customer relative to a fuel dispenser. For example, audio instructions or a greeting may be provided through the audio module 26.

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Referring now to Figure 2, a schematic for a basic control system and touch screen display is shown. The control system includes controller 20 and memory 22 coupled to the video mixer and driver electronics 46, touch screen electronics 58, and back-lighting control electronics 56. The video mixer and driver electronics are coupled to the graphics
10 generator 50, which provides graphics for display on the touch screen display 40, and the video source 52, which provides running audio and/or video for display. The video source may include, but is not limited to, laser disks, DVD's, the Internet and video cameras. The touch screen electronics 58 typically provide signals to the controller 20 indicative of where the display 40 has been touched in order to differentiate customer inputs and
15 selections.

As noted above, the display 40 and touch screen electronics 58 may be configured to operate in a highly sensitive mode wherein the display and touch screen electronics 58 are able to sense changes in a field emitted from the display 40 without requiring an actual
20 touching of the display. Preferably, this field will extend up to several feet in front of the display over a respective fuelling position in front of the dispenser 10.

In the preferred embodiment, the display is a capacitive touch screen display capable of operating at various frequencies to provide various sensitivity levels. Typically, the

increased frequencies provide higher sensitivity. An exemplary capacitive touch screen display is manufactured by Microtouch™. This display could sense a customer coming within four (4) feet of the display. Thus, in the preferred embodiment, the controller 20 could increase the frequency and, therefore, the display's sensitivity between fuelling
5 operations in order to sense the approach and/or presence of a customer at the beginning of a new fuelling operation.

The controller 20 may be adapted to control display back-lighting 54 through back-lighting control electronics 56. Depending on the application, the back-lighting may be decreased
10 from a nominal operating level or turned completely off between fuelling operations, to reduce heat and conserve energy. Preferably, once a customer is detected within a relative proximity to the fuel dispenser, the back-lighting is increased or turned on to the normal operating level in order to make the display content readily visible to the customer as well as draw the customer's attention to the display.

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As shown in Figure 3, the controller 20 may also be coupled to one or more proximity sensors 48 located at various positions in numerous possible configurations about the display 40. These proximity sensors 48 may be used instead of or in addition to a display 40 for sensing proximity. Notably, when multiple proximity sensors 48 are used, the
20 controller 20 may be configured to monitor the relative proximity of a customer measured at each of the proximity sensors 48 to determine a relative location of the customer with respect to the dispenser and display 40. This information may be used to control the viewing angle on an LCD display and/or change fonts or text sizes accordingly to enhance visibility.

For example, if proximity sensors 48 were located on either side of the display 40, the display could be adjusted so that the horizontal viewing angle is properly adjusted. In other words, if a person were standing to the right of the display, the control system would determine that the customer was more proximate to the proximity sensor 48 to the right of the display than to the proximity sensor 48 to the left of the display. The viewing angle of the display could be adjusted accordingly. Likewise, proximity sensors 48 located at the top and bottom of the display may be used to adjust the vertical viewing angle based on the height of the individual. Combining proximity sensors on either side and the top and bottom of the display provides a more enhanced control of viewing angles on both the horizontal and vertical planes.

As noted, if the dispenser is equipped with a touch screen display 40 capable of operating at a higher sensitivity to detect customer proximity, various control capabilities are available. An exemplary process is shown in Figure 4. The process begins (block 100) wherein the controller 20 operates the display 40 at a high sensitivity (block 102). The controller 20 will preferably turn off or reduce the back-lighting (block 104) to conserve energy and reduce heat buildup during this period. Alternatively, the controller 20 may provide a first video/graphic display. Preferably, this display occurs during periods between fuelling operations (block 106).

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The controller 20 will monitor the display 40 and associated touch screen electronics 58 for an indication of a customer's presence (block 108). If a customer is detected (block 110), the controller 20 will turn on or increase the back-lighting to a preferred level (block 112) and/or provide a second video/graphics display (block 114). The second display is

preferably adapted to provide instructions or welcoming information corresponding to the beginning or start of a fuelling operation. The controller 20 will typically reduce the sensitivity of the display 40 to provide normal touch-sensitive operations (block 116). The fuelling operation will continue and the controller 20 will monitor for an end of the
5 fuelling operation (block 118). At the end of the fuelling operation (block 120), the process begins anew (block 102) wherein the display is operated at a high sensitivity, the back-lighting is reduced or turned off, and the first video/graphics display is provided. The controller 20 will monitor for the presence of a customer to start a new fuelling operation.

10 Figures 5A and 5B are a flow chart representing the basic process of providing advanced control based on determining the location of a customer relative to the dispenser and/or display. This process typically requires at least two proximity sensors, one of which may be the display 40 operated in a high-sensitivity mode. The Microtouch™ display may control sensitivity by varying the operational frequency.

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The process begins (block 200) wherein the display is operated in a first mode. The display mode may relate to the type of information displayed, whether the display is in an active or inactive mode, or whether back-lighting is turned off or decreased from a normal operating level. Typically, the first mode relates to display operation during non-fuelling
20 periods.

At this point, the controller 20 monitors for the presence of a customer relative to the fuel dispenser (block 204). Once a customer is detected (block 206), the controller 20 monitors the proximity signals received at each sensor (block 208) and calculates the relative

customer location (block 210) based on these proximity signals. Once the customer is detected or determined to be in a certain location, the controller 20 operates the display in a second mode, which typically attracts the attention of a customer, provides instructions or welcoming information, and/or awakens from an inactive mode. The controller 20 may
5 change the video/graphic display (block 214), change back-lighting levels (block 216), and preferably adjust the viewing angle (block 218) based on customer location as discussed above.

The controller 20 will continue to monitor customer location throughout the fuelling
10 operation (block 220). If a change in location is detected (block 222), the controller 20 will determine whether the fuelling operation is at an end (block 224) and adjust the viewing angle if the operation is not at an end (block 226 and 218). The end of a fuelling operation may be determined by sensing the nozzle handle being pulled down, detecting the absence of a detection signal for a select period, or sensing the end of fuel delivery. The modes
15 may include various audio modes instead of, or in addition to, the video modes. For example, once a customer is within a certain proximity, an audible message may be provided alone or in combination with a different display mode.

The present invention provides a fuel dispenser capable of sensing the approach, relative
20 proximity and/or location of a customer relative to the fuel dispenser and controls the fuel dispenser accordingly without requiring customer input. The invention draws customers' attention to the display on approach, provides information to a customer in order to start the fuelling operation, reduces heat, saves energy, and reduces the number of components necessary to manufacture dispensers providing high-quality, multimedia displays.

Certain modifications and improvements will occur to those skilled in the art upon reading the foregoing description. It should be understood that all such modifications and improvements have been deleted herein for the sake of conciseness and readability, but are properly within the scope of the following claims.

CLAIMS

1. A fuel dispenser comprising: a housing and delivery hardware for delivery of fuel to a vehicle; display means within said housing having a first and second mode; proximity sensing electronics associated with said housing and adapted to sense proximity of a customer relative to said housing; and a control system coupled with said display means and said proximity sensing electronics and adapted to operate said display means in the first mode and operate said display means in the second mode when a customer is in a predetermined position relative to said dispenser.
2. A fuel dispenser as claimed in claim 1 wherein said position is within a predetermined proximity relative to said dispenser.
3. A fuel dispenser as claimed in claim 1 or claim 2 wherein said first mode for said display means is an inactive state and said second mode for said display means is an active state.
4. A fuel dispenser as claimed in claim 1 or claim 2 wherein said first mode for said display means provides a dimmer display and said second mode for said display means provides a brighter display.
5. A fuel dispenser as claimed in claim 4 wherein said display means is a liquid crystal display with back-lighting, said control system being adapted to operate said back-lighting at a reduced level in said first mode and at an increased level in said second

mode.

6. A fuel dispenser as claimed in any one of claims 1 to 5 wherein said control system provides a first display on said display means in said first mode and a second display on said display means in said second mode.

7. A fuel dispenser as claimed in claim 6 wherein said first display is a non-transaction display and said second display is a pre-transaction display providing content aiding the customer in beginning a transaction.

8. A fuel dispenser as claimed in any one of claims 1 to 7 wherein said control system is associated with a video source for generating video information on said display means.

9. A fuel dispenser as claimed in any one of claims 1 to 8 wherein said control system is associated with a graphics generator for generating graphics for display on said display means.

10. A fuel dispenser as claimed in any one of claims 1 to 9 wherein said display means includes a touch screen display comprising said proximity-sensing electronics, wherein said touch screen display is arranged to operate in a highly sensitive mode in the first mode to sense proximity of a customer relative to said display means and operate in a less sensitive mode to provide a touch screen display in said second mode.

11. A fuel dispenser as claimed in any one of claims 1 to 9 wherein said proximity

sensing electronics includes a proximity sensor coupled to said control system.

12. A fuel dispenser as claimed in claim 11, wherein the proximity sensing electronics comprises a second proximity sensor, wherein said control system compares said signals from said proximity sensors to determine a location of the customer relative to said housing.

13. A fuel dispenser as claimed in claim 12 wherein said second display mode is operated to adjust viewing in dependence on the detected location of the customer.

14. A fuel dispenser as claimed in any preceding claim wherein said display means displays text, said text having a text point size being one size in said first mode and a larger size in said second mode.

15. A fuel dispenser as claimed in any preceding claim further comprising an audio system and wherein said second mode includes providing audible information through said audio system.

16. A method of operating a fuel dispenser comprising: operating a fuel dispenser display means in a first mode; sensing a customer in a predetermined position relative to the fuel dispenser; and operating the fuel dispenser display means in a second mode upon sensing the customer in the predetermined position.

17. A method as claimed in claim 16 wherein the first operating step includes

displaying a first display on the display means and the second operating step includes displaying a second display on the display means.

18. A method as claimed in claim 17 wherein the first display includes a non-transaction display and the second display includes a pre-transaction display.

19. A method as claimed in any one of claims 16 to 18 wherein the first operating step includes operating the display means in a dim mode and the second operating step includes operating the display means in a bright mode.

20. A method as claimed in any one of claims 16 to 19 wherein the first operating step includes operating the display means in an inactive state and the second operating step includes operating the display means in an active state.

21. A method as claimed in any one of claims 16 to 20, further comprising determining a location of the customer relative to the fuel dispenser.

22. A method as claimed in claim 21, further comprising operating the display means to adjust a viewing angle of the display in dependence on the detected location of the customer.

23. A customer interaction device comprising: a housing; display means within said housing having a first and second mode; proximity sensing electronics associated with said housing and adapted to sense proximity of a customer relative to said housing; and a

control system coupled with said display means and said proximity sensing electronics and adapted to operate said display means in the first mode and operate said display means in the second mode when a customer is in a predetermined position relative to said housing.

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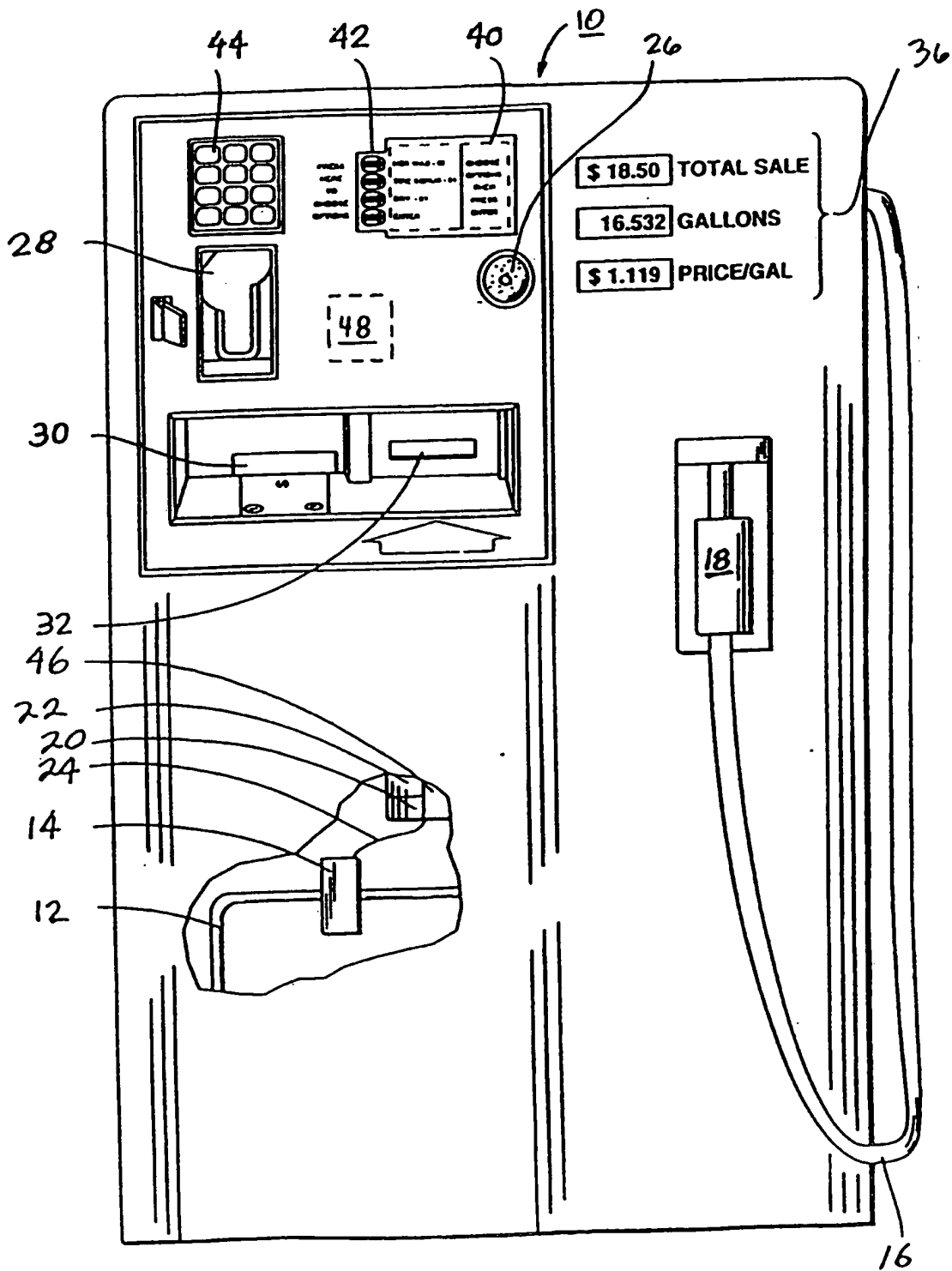


FIG.1

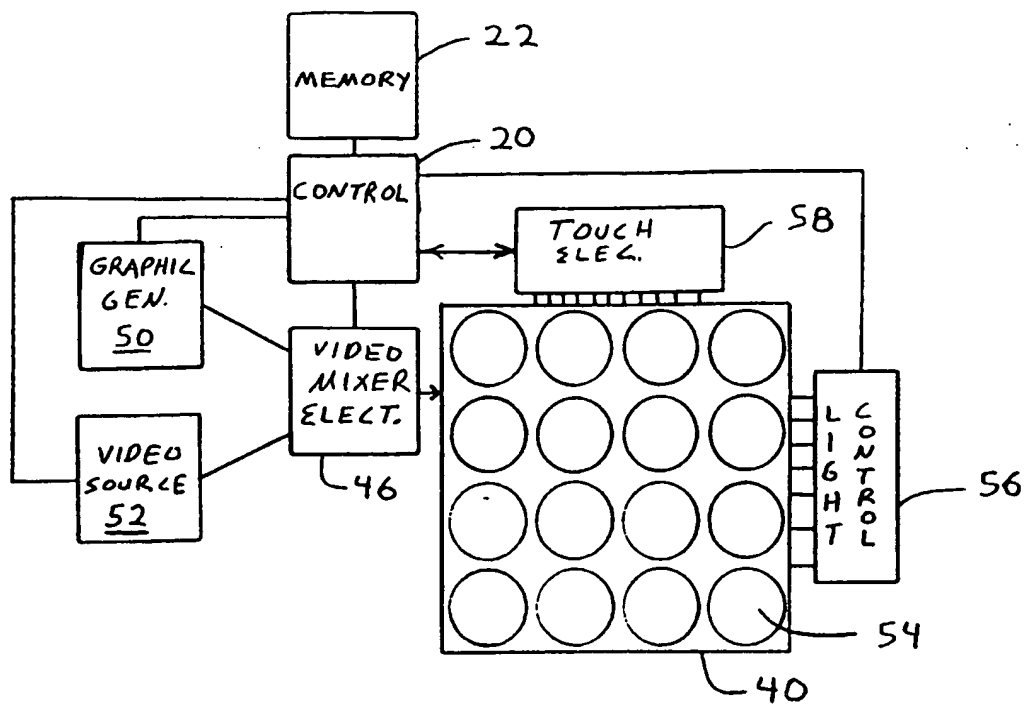


FIG. 2

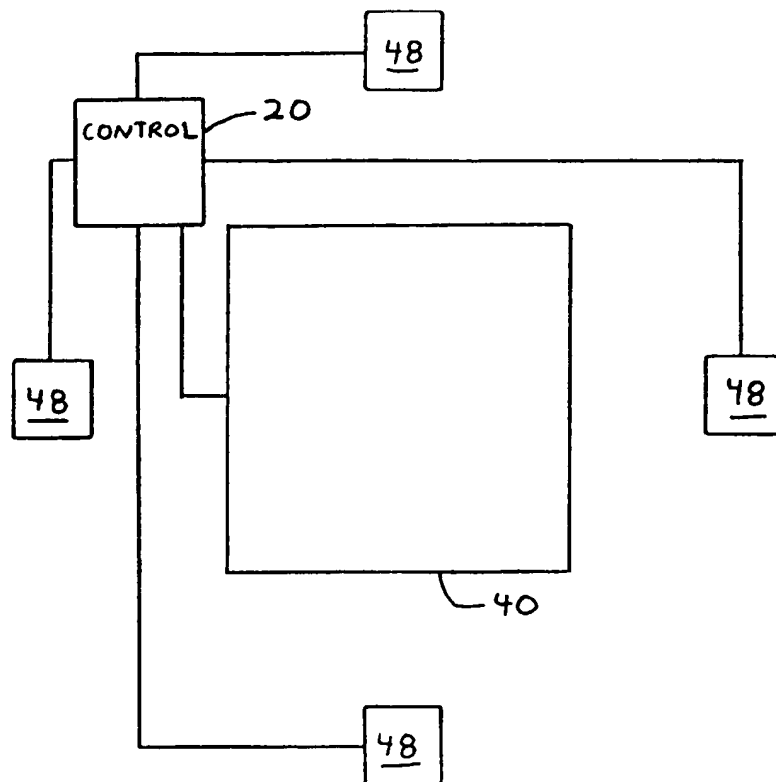


FIG. 3

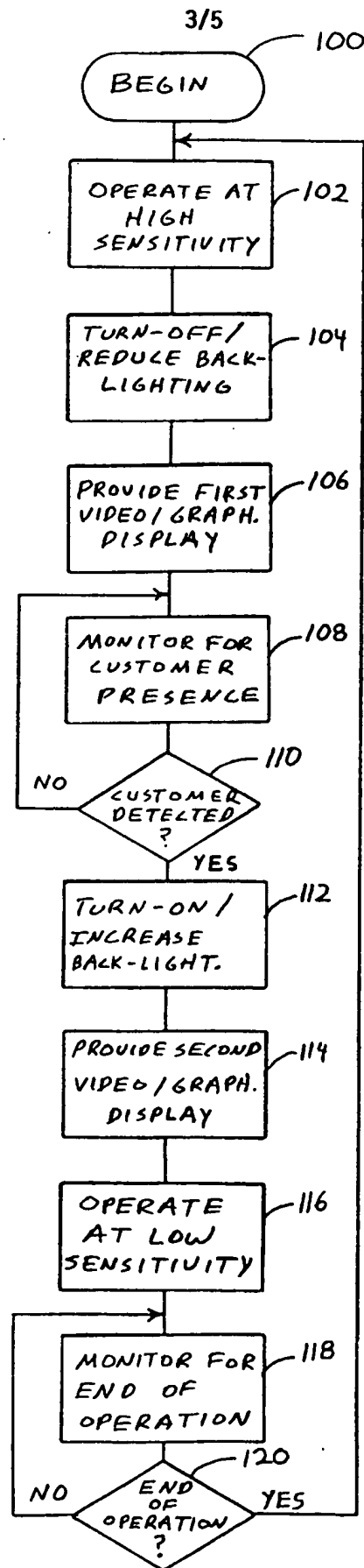


FIG. 4

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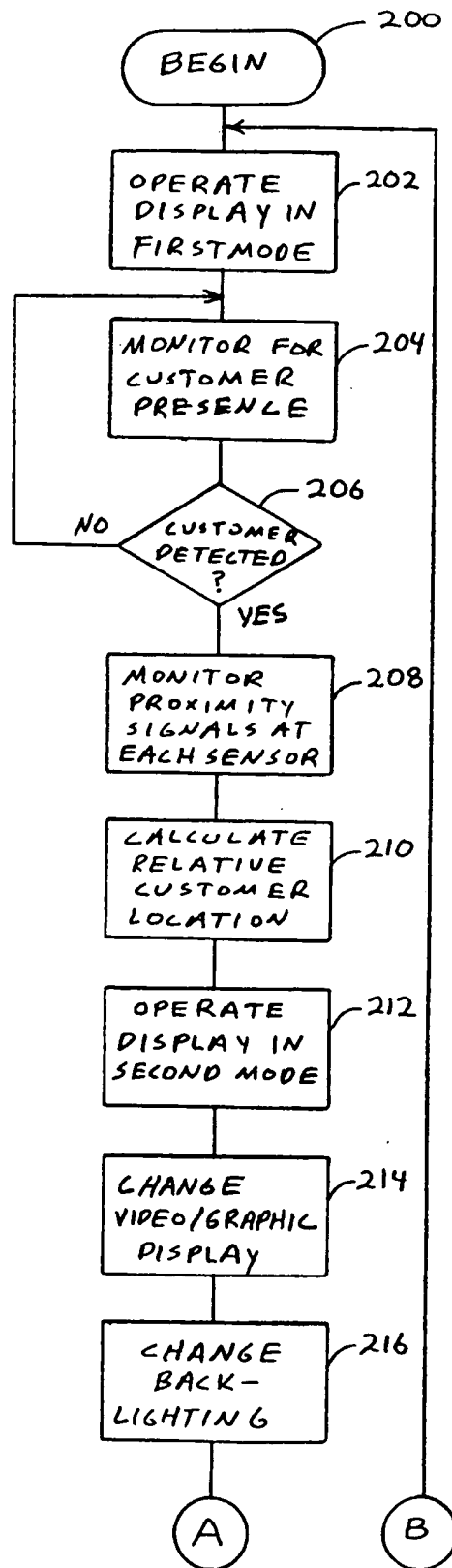


FIG. 5A

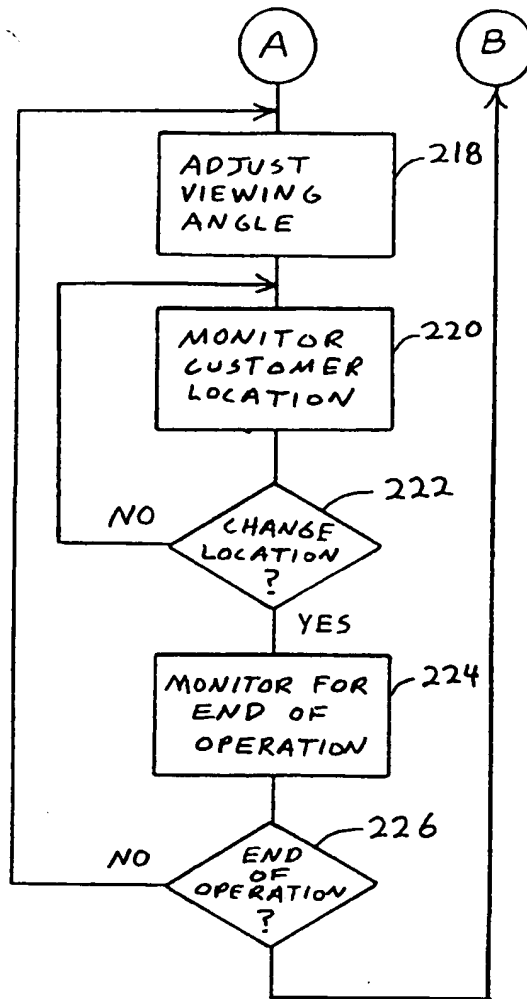


FIG. 5B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/00554

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G07F13/02 G07F9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G07F G09B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 596 501 A (MASTEJ EUGENE ET AL) 21 January 1997 see abstract see column 2, line 51 - line 61 see column 3, line 38 - column 4, line 13 see column 6, line 33 - line 44 see column 8, line 13 - line 49 see figure 3	1-4, 6, 11, 16, 19, 23
A	US 4 900 906 A (PUSIC PAVO) 13 February 1990 see column 4, line 58 - column 6, line 28 see figures 15-17 --- -/--	1-5, 11, 16, 21, 23

<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.		<input checked="" type="checkbox"/> Patent family members are listed in annex.	
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>			
Date of the actual completion of the international search 21 May 1999		Date of mailing of the international search report 31/05/1999	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Bocage, S	

INTERNATIONAL SEARCH REPORT

Intr onal Application No
PCT/GB 99/00554

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 5 097 981 A (MANZO SCOTT E ET AL) 24 March 1992</p> <p>see abstract see column 3, line 48 - column 5, line 22 see figure 1</p> <p style="text-align: center;">---</p>	<p>1-4, 8, 11, 12, 15, 16, 21, 23</p>
A	<p>US 5 117 407 A (VOGEL PETER S) 26 May 1992</p> <p>see column 1, line 36 - line 55 see column 2, line 37 - column 4, line 55 see column 6, line 33 - line 47 see figure 2</p> <p style="text-align: center;">---</p>	<p>1, 2, 8-11, 15, 16, 21, 23</p>
A	<p>US 5 630 357 A (AKIYAMA MINEO) 20 May 1997</p> <p>see column 2, line 17 - line 37 see column 7, line 11 - line 29 see figures 1, 6</p> <p style="text-align: center;">-----</p>	<p>1, 2, 10, 11, 15, 16, 21</p>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/00554

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5596501 A	21-01-1997	CA 2181608 A	20-01-1997
US 4900906 A	13-02-1990	NONE	
US 5097981 A	24-03-1992	AU 7448491 A	05-08-1991
		CA 2073687 A,C	13-07-1991
		EP 0510121 A	28-10-1992
		WO 9110977 A	25-07-1991
US 5117407 A	26-05-1992	AU 628801 B	24-09-1992
		AU 3069589 A	06-09-1989
		WO 8907807 A	24-08-1989
US 5630357 A	20-05-1997	JP 8335291 A	17-12-1996